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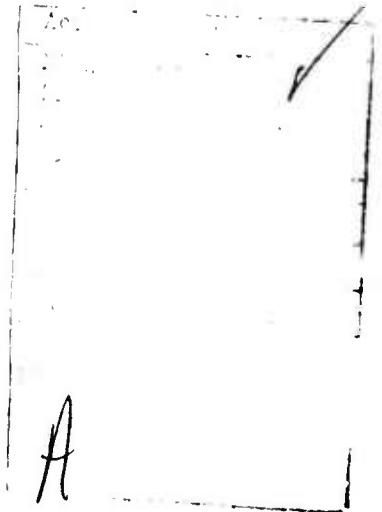
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THE IDEAS OF FREDERICK W. TAYLOR: AN EVALUATION¹

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Abstract

The ideas and techniques of Frederick W. Taylor, the founder of Scientific Management, were examined with respect to their validity and their degree of acceptance in modern management. With respect to the principle of scientific decision-making and techniques such as: time and motion study, standardization, goal setting with feedback, money as a motivator, management responsibility for training, scientific selection, the shortened work week and rest pauses, Taylor's views were fundamentally correct and have been generally accepted. With respect to individualized work and the principle of labor-management cooperation, his views were probably only partially correct and have been only partially accepted. Criticisms of Taylor with respect to his alleged: inadequate view of motivation, ignorance of social factors, authoritarianism, treatment of men as machines, exploitation of workers, anti-unionism, and personal dishonesty are predominantly or wholly false. The accusation concerning over-specialization is only partially justified. Generally Taylor's contributions and his genius have not been understood or appreciated by contemporary writers.

The Ideas of Frederick W. Taylor: An Evaluation¹

Few management theorists have been more persistently criticized than Frederick W. Taylor. Despite being credited as the founder of Scientific Management and as one of the key figures in the history of management thought (Wren, 1979), he was strongly criticized in his own day, and despite his widespread influence, has been frequently disparaged ever since (even by Lillian Gilbreth, see Urwick, 1971/1978). He is routinely attacked today in virtually every book on the topics of organizational behavior, personnel management, and work motivation. Pointing out the inadequacies of Scientific Management has become positively fashionable in modern management texts.

I believe, in agreement with Drucker (1976, although not with all of his specific points), that Taylor has never been fully understood or appreciated by his critics. Most criticisms have either been invalid or have involved peripheral issues, while his major ideas and contributions have gone unacknowledged. As Boddewyn (1961) notes, many critics have simply quoted earlier critics rather than reading Taylor first-hand.

Wren (1979) has done a superb job of showing how Taylor's major ideas permeated the field of management both in the U.S. and abroad. However, Wren was not primarily concerned with evaluating all of Taylor's techniques or the criticisms of his ideas. Boddewyn (1961), Drucker (1976) and Fry (1976) have made spirited defenses of Taylor but more by way of broad overviews (with a few specific examples) than

in systematic detail. The present paper will summarize Taylor's major ideas and techniques and consider both their validity and their degree of acceptance in contemporary management. In addition, the major criticisms made of Taylor will be systematically evaluated.

Taylor's Philosophy of Management

The essence of Taylor's philosophy of management, as the name of the movement implies, was a scientific approach to managerial decision-making (Taylor, 1912/1970 b; see also Sheldon, 1924/1976). The name was intended to contrast his approach with the unscientific approaches which characterized traditional management practices. By scientific, Taylor meant: based on proven fact (e.g., research and experimentation) rather than on tradition, rule of thumb, guesswork, precedent, personal opinion, or hearsay. The results of Taylor's scientific approach to management are best exemplified by: his design of a steam hammer (based on repair data on existing hammers from all over the world) that went years without a single breakdown; his discovery of high speed steel which is credited with helping to win World War I (both described in Fisher, 1925/1976); the development (with Carl Barth) of a mathematical formula and slide rule which revolutionized the "art" of metal cutting; and the systematic use of time study (Taylor, 1911/1967).

There can be no doubt that the essence of Taylor's philosophy is accepted in modern management (This is not to say that all contemporary managers are fully rational decision-makers. This is clearly not the case. However, most would subscribe to the principle of

scientific decision-making and many actually practice it, at least with respect to some of their decisions.). In most business schools there is now a specialized field called Management Science (which includes Operations Research), but the scientific approach is reflected everywhere: in employee selection, in evaluating incentive techniques, in plant design and construction, in accounting (e.g., cost accounting), in marketing (e.g., market analysis, market surveys), in purchasing and inventory control, in planning (e.g., the Gantt and PERT charts), in human engineering, in investment decisions, etc. (see Kendall, 1924/1976).

While Taylor cannot take credit for all of these particular applications and developments, he can be credited with helping to instill a new, scientific, way of thinking among managers. His goal was to forge a "mental revolution" in management and in this aim he clearly succeeded. Drucker (1976) wrote that, "Taylor was the first man in history who actually studied work seriously" (p. 26).

A second element of Taylor's philosophy of management, and the other key aspect of the mental revolution which he advocated, concerned the relationship between management and labor. At the turn of the century, the Marxian "class struggle" premise was accepted by managers and workers alike. It was assumed that there was a fundamental conflict of interest between labor and management, especially regarding the issue of wages.

Taylor argued that this prevailing view was false, that at root, the interests of both parties were the same. Both would benefit, he

argued, from higher production, lower costs, and higher wages, providing management approached its job scientifically. Taylor believed that there would be no conflict over how to divide the pie providing the pie were large enough (Taylor, 1912/1970b).

In logic, one cannot argue with Taylor's fundamental premise of a community of interest between management and labor. (There were virtually no strikes in plants where he applied Scientific Management, Taylor, 1911/1967, p. 135; 1912/1970a, p. 80). Wren (1979) notes that, during the 1920's, Taylor's hopes for union cooperation in introducing Scientific Management and in reducing waste were realized to a considerable extent, especially in the clothing and railroad industries. Unfortunately this attitude of cooperation ended in the 1930's when unions turned their attention to the passage of pro-labor legislation.

Despite this about face, it is clear that, in general, management labor relations are far more amicable on the average now than at the turn of the century. In practice (in actual bargaining,) labor unions in the private sector recognize that their demands must be limited according to the ability of companies to survive in a competitive environment. However, the public stance of most unions today is still one which stresses an adversary relationship between management and labor. Furthermore, it is clear that no matter how big the pie is, there can still be disagreements over how to divide it up. Taylor did not anticipate that as the pie got bigger, aspirations would rise accordingly, especially during times of inflation.

Thus, on the issue of labor-management relations, while Taylor's basic premise seems eminently sound, all conflict clearly has not been eliminated as he had hoped.

Taylor's Techniques

1. Time and motion study. Before Taylor, there was no objective method for determining how fast a job should be done. Most managers simply used past experience as a guide. Taylor's solution was: to break down the work task into its constituent elements or motions; to eliminate wasted motions so the work would be done in the "one best way" (Taylor, 1912/1970a, p. 85; this principle was emphasized even more strongly by Frank Gilbreth; e.g., see Gilbreth, 1923/1970); and to time the remaining motions in order to arrive at an expected rate of production (a proper day's work).

This procedure is now fully accepted and routinely implemented in every industrialized country in the western world. In some respects, time study has become even more exact. For example, on most jobs predetermined or standard times for each basic motion can be used, thus obviating the need for a separate study of each new job.

There has been no final solution to the problem of (partially) subjective elements in time study (e.g., fatigue allowances); nor has worker resistance to time study disappeared, although it should be noted that resistance is most likely when there is lack of trust in management (Bartlem & Locke, 1980). Such lack of trust is often earned by practices such as rate-cutting--something which Taylor explicitly warned against.

2. Standardized tools and procedures. Before Scientific Management every workman had his own private tool box which resulted in great inefficiencies, since the proper tools were not always used or even owned. Taylor pushed strongly for standardization in the design and use of tools. The tools and procedures were designed according to what experiments had shown to be most effective in a given context (e.g., the best size and shape for coal shovels, the best machine speed for cutting a given metal). The tools and machines were designed to minimize fatigue and maximize production.

Like time study, the principle of standardization is now fully accepted. Combined with the principle of designing tools to fit people, the technique of standardizations has evolved into the science of human engineering. Standardization also has been extended beyond the sphere of tool use to include all types of organizational procedures especially in large firms.

3. The task. Taylor advocated that each worker be assigned a specific amount of work, of a certain quality, each day based on the results of time study. This assigned quota he called a "task" (Taylor, 1911/1967, p. 120). The term task is roughly equivalent to that of goal. Thus the task concept was the forerunner of goal-setting.

The efficacy of giving employees specific challenging goals to aim for is now widely acknowledged. When used for managers, it is called Management by Objectives or MBO (the similarities and differences between goal setting under Scientific Management and MBO are discussed in Locke, 1978). It is worth noting that Wren's (1979, pp. 203-205)

discussion of Scientific Management at DuPont and General Motors implies that there is an historical connection between it and the technique of Management by Objectives. Pierre DuPont adapted Taylor's cost control ideas in order to develop measures of organizational performance (such as "return on investment") for the Dupont Powder Co. One of his employees, Donaldson Brown, further developed the return on investment concept so that it could be used to compare the efficiency of various departments within Dupont. When Pierre Dupont became head of General Motors, he hired Brown and Alfred P. Sloan, who institutionalized Brown's ideas. Ducker credits Sloan as the originator of the MBO concept (although it was not called by that name until Drucker labeled it in 1954). This analysis suggests that, while MBO may have been an outgrowth of Scientific Management, it developed more directly from the concepts of feedback, performance measurement and cost accounting than from the task concept. (Taylor had introduced an interlocking cost and accounting system as early as 1893; Copley, 1923, Vol J, p. 392).

Another term used widely today is Organizational Behavior Modification; most "OB Mod" studies merely involve goal-setting with feedback, described in pseudo-scientific terminology (Locke, 1977). Virtually every contemporary theory of or approach to motivation now acknowledges the importance of goal setting either explicitly or implicitly (Locke, 1978).

The main effect of the post-Taylor research has been to support the validity of his practices. For example, we have learned

that specific, challenging goals lead to better performances than specific, easy goals; vague goals such as "do your best"; or "no" goals (Locke, 1968; Locke, Shaw, Saari and Latham, 1980). Taylor anticipated these results since the tasks his workers were assigned were, in fact, both specific (quantitative) and challenging (set by time study to be reachable only by a trained, "first class" workman; Taylor, 1903/1970). Remarkably, Alfred P. Sloan himself had said that, "The guiding principle was to make our standards difficult to achieve, but possible to attain, which I believe is the most effective way of capitalizing on the initiative, resourcefulness, and capabilities of operating personnel" (quoted in Odiorne, 1978, p. 15).

Further, it now seems clear that feedback (knowledge of one's progress in relation to the task or goal) is essential for goal setting to work (e.g., Locke et al, 1980), just as it is essential to have goals if feedback is to work (Locke, Cartledge & Koepfel, 1968). Again Taylor anticipated these findings: his workers were given feedback at least daily indicating whether or not they attained their assigned task (Taylor, 1911/1967, p. 68; a precursor of evaluative feedback for workers, developed a century before Taylor, was Robert Owen's "silent monitor" technique; described in Wren, 1979, p. 72).

A precondition of feedback is objective work measurement which Taylor also emphasized. Ratings are still more popular today than performance measurement, but there appears to be a trend in the direction of developing objective measures as a result not only of the influence of MBO, but also of job enrichment (which stresses quantitative feedback about performance) and "behavior mod."

4. The money bonus. Taylor claimed that money was what the worker wanted most and argued that he should be paid from 30% to 70% higher wages in return for learning to do his job according to Scientific Management principles (i.e., for "carrying out orders," Boddewyn, 1961, p. 105) and for regularly attaining the assigned task.

At first glance, it would appear that Taylor's emphasis on money as a motivator has been widely rejected. For example, Taylor's differential piece rate scheme and Gantt's task and bonus system have not come into wide use, despite evidence that they may be more effective than a straight piece rate method of payment (Locke, Bryan and Kendall, 1968). Furthermore, money has been consistently attacked by social scientists from the Hawthorne studies to the present on the grounds that it is an inadequate motivator. It is also claimed that a smaller percentage of workers are now on incentive pay than in the past, although this may be due, in large part, to the fact that there has been a decrease in the number of workers in manufacturing (where performance is easier to measure) and an increase in the number in service jobs (where performance is harder to measure).

But if one looks at other management and union practices, it is clear that Taylor's claim--that money was what the worker wanted most--was not entirely misguided. A plethora of new incentive schemes have developed since Taylor's time and new ones are still being tried (e.g., Latham and Dossett, 1978), not only for workers but for managers as well. Most labor-management conflicts still involve the issue of wages or issues related to wages (seniority, rate setting, layoffs, fringe

benefits, etc.). New analyses of the Hawthorne studies indicate that their disparagement of money as a motivator was wrong (Carey, 1967; Franke and Kaul, 1978; Sykes, 1965; see also Lawler, 1975) and recent books and articles are again advocating the use of money to motivate workers (e.g., Lawler, 1971; Locke, 1975; Vough, 1975).

Aspersions on the importance of money as a motivator became so extreme at one point, that W. F. Whyte, who himself had written an entire book pointing out its limitations (Whyte, 1955), found it necessary in a later article to reassert the importance of money (Whyte, 1961).

Pay has become a major issue even in the famous Topeka experiment at General Foods which was intended to stress job enrichment and participation (Walton, 1977), and is a key element in the still popular Scanlon Plan (Frost, Wakeley & Ruh, 1974), long considered a Human Relations/Organizational Development technique. The pendulum now clearly seems to be swinging back toward Taylor's view (see Locke, Feren, McCaleb, Shaw & Denny, in press). Interestingly, one of the most outspoken contemporary advocates of money as a motivator is, like Taylor, an industrial engineer, Mitchell Fein. Fein has developed a new plant-wide incentive system called "Improshare" (Fein, 1977) which is coming into increasingly wide use.

Taylor also stressed that monetary rewards should not be given too long after task accomplishment (thus his disparagement of profit sharing plans, Taylor, 1912/1976), a point which would be fully agreed to by "behavior mod" advocates. It should be noted, however, that

Taylor's view of the efficacy of man's mind was infinitely higher than that of B. F. Skinner. (I will have more to say about the power of money as a motivator below).

5. Individualized work. Taylor was a staunch advocate of individual as opposed to group tasks, as well as individual rewards, because he believed that groupwork and rewards undermined individual productivity, due to such phenomena as "systematic soldiering." Taylor wrote, "Personal ambition always has been and will remain a more powerful incentive to exertion than a desire for the general welfare" (1912/1976, p. 17). In this respect, Taylor's views are in clear opposition to the trend of the past four to five decades which has been toward group tasks. There are probably several reasons for this trend including: beliefs about the worker's social needs; the greater flexibility that occurs with multicrafting and team assembly; the greater interdependence and complexity of many work tasks today; the frequent pressures put on "deviant" individuals by other workers, etc. Boddewyn (1961) notes that Taylor's espousal of individual work was related to his own "Protestant Ethic" value system. Another reason for the recent emphasis on groups is undoubtedly the rise of the "Social Ethic" (collectivism) at the expense of the Protestant Ethic (individualism).

Nevertheless, Taylor's warnings about the dangers of group work have proven to have some validity. For example, Janis (1972) has demonstrated that groups which become too cohesive are susceptible to groupthink, a cognitive disorder in which rational thinking is sacrificed in the name of unanimity. Latané, Williams and Harkins

(1979) have documented a phenomenon called "social loafing" in which people working in a group put out less effort than when working alone even when they claim to be trying their hardest in both cases. While social loafing is related to "systematic soldiering," the latter refers to a conscious limitation of output whereas Latané et al imply that social loafing occurs even when there is no conscious intent to restrict effort. Presumably it is the result of a subconscious premise to the effect, "Let George do it!"

Studies of group decision making indicate that there is no universal superiority of groups over individuals. Often the best individual in a group is superior to the group as a whole (Hall, 1971). Fein (1977) admits that, while group incentives are generally preferable to individual incentive plans, because they induce greater cooperation, many individuals will work less hard under the group plans.

The current view seems to hold that while people may work less hard in groups (as Taylor claimed), the benefits in terms cooperation, knowledge and flexibility generally outweigh the costs. Overall, the evidence is not conclusive one way or the other. Most likely the final answer will depend upon the nature of the task and other factors.

While Taylor opposed group or gangwork, he was very much in favor of cooperation among individuals, not only between management and labor, but within each group. However, he did not develop any specific mechanism to encourage this except high wages.

6. Management responsibility for training. In line with his emphasis on a scientific approach to management, Taylor argued that employees should not learn their skills haphazardly from more

experienced workers, who may not be using the "one best way", but from management experts who were thoroughly familiar with the job. There can be no doubt that most contemporary managers fully accept the notion that training new employees is their responsibility. Furthermore the objective evaluation of training is becoming increasingly common.

7. Scientific selection. Taylor advocated selecting only "first class" (i.e., high aptitude) men for a given job because their productivity would be several times greater than that of the average man. Colleague Sanford E. Thompson's use of a measure of reaction time test to select bicycle ball bearing inspectors (Taylor, 1911/1967, pp. 86ff) was one of the earliest efforts at objective selection. (It is not clear whether Taylor believed that aptitude or ability was innate or could be developed through hard work--or both. Thompson's test of reaction time was thought to be a measure of innate capacity, Taylor, 1911/1967, p. 89. However, Taylor's adopted son, Robert, recalled that his father, "used to say that any person who was normally endowed and was willing to put in four years of hard work could become an expert in any field", Bromer, Johnson & Widdicombe, 1978, ch. 6, p. 10. These two views are not really contradictory, since the first example refers to a physiological capacity while the second refers to the acquisition of knowledge. Taylor clearly believed that hard work had a major impact on performance.)

Thompson's selection testing antedated the pioneering work of Hugo Munsterberg (1913) and as well as the more systematic attempts at validation of selection tests conducted by American psychologists

for the Army during World War I. Since that time, personnel selection has mushroomed enormously and has become a science in its own right. The techniques used today have gone far beyond anything envisioned by Taylor; but all these developments, from intelligence testing to the assessment center, are consistent with his basic philosophy. Wren (1979) notes that Taylor's emphasis on scientific selection was an impetus to the development of the fields of Industrial Psychology and Personnel Management. (Shortly before his death in 1915, Taylor was asked to serve on the Board of Directors of the Society of Applied Psychology²).

8. Shorter working hours and rest pauses. Taylor's experiments with pig-iron handlers and ball bearing inspectors determined that fatigue would be reduced and more work would be accomplished if employees were given shorter working hours and/or rest pauses during the day in proportion to the difficulty of the work. The findings with respect to a shorter work week were corroborated by the British experiments during World War I (reported in Vernon, 1921) and are now fully accepted. Similarly, the beneficial effects of periodic rest pauses have been documented in numerous experiments (see Ryan, 1947, for a discussion of both issues). Rest pauses, especially for heavy manual work and for perceptual monitoring tasks, are routinely provided in most jobs today.

The above list does not exhaust the fascinating insights of Taylor. For example, he once gave a talk (Taylor, 1909/1976) on how to influence your boss in such a way as to increase your chances for advancement (do exactly what he wants, only more; give results, not excuses).

Some recent data gathered by Schilit (1980) support the notion that being competent gives one more upward influence than not being competent.

Taylor was also acutely aware of the issue of resistance to change. In fact, he spent much of his career trying to overcome the resistance of workers, managers, union leaders and government officials to his ideas. He astutely observed that just because an idea is valid or works does not mean that it will be accepted (see Fisher, 1925/1976, p. 172ff for details). Managers can be threatened because they did not think of the ideas or changes themselves or because the success of the changes implied (to them) that they had not been doing a competent job before. Workers resisted change because of laziness and (justified) distrust of management. To overcome management resistance, Taylor needed support at the top i.e., a mental revolution on the part of the chief executives (Fisher, 1925/1976, p. 174). To overcome worker resistance, he sometimes used demonstrations: he would apply his system to a single volunteer worker and then count on the higher pay received by this worker to induce the others to try it (1903/1947, p. 192).

Today, of course, participation is the recommended technique for overcoming resistance to change. However, there is no convincing evidence that participation works better than any other method, such as simply telling the employee what to do (Locke & Schweiger, 1979).

Now that we have identified Taylor's philosophy and described his major techniques, let us evaluate the criticisms that have been made of him and his ideas.

Criticisms of Taylor

1. Taylor's view of work motivation was hopelessly inadequate. McGregor's Theory X asserts that the average worker is naturally lazy, does not want to work, lacks ambition and must be controlled constantly through reward and punishment and closely supervised if any work is to be accomplished. Clearly this theory was meant to characterize Taylor's assumptions about man and was intended to stress, by contrast with Theory Y, the arbitrary narrowness of Taylor's premises. Taylor, of course, did assert that "natural soldiering" (laziness) existed, but he saw it as far less important than "systematic soldiering" which resulted from working with other men under poor management (Taylor, 1911/1967, pp. 20ff). He argued that what the worker wanted most was money and that good management would provide the conditions under which the workman could be assured of earning large amounts of it consistently. This, he claimed, would overcome the tendency to soldier. Taylor's basic premise was not that men disliked work but that they would not work or follow directions unless they attained some permanent, personal benefit from it. This assumption is fully in accord with the tenets of expectancy theory (Vroom, 1964).

What is the evidence for the power of money as motivator? The present author and his students recently analyzed all available field studies which examined the effectiveness of each of four motivational techniques: money, goal setting, participation in decision making, and job enrichment (Locke, et al, in press). It was found that the median performance improvement resulting from individual incentive systems was 30%; this figure was far higher than that for any of the

other incentives. The median figure for group or plant-wide incentive schemes was 18%, still higher than for any non-monetary technique. These findings (which were based mainly on studies of blue collar workers) coincide with the results of numerous recent surveys which indicate that extrinsic incentives such as money are more important for blue collar than for white collar employees (Locke, 1976; this should not be taken to imply that money is unimportant to white collar and professional workers).

Taylor's other major motivational technique was goal setting, i.e., assigning specific tasks. (Interestingly, McGregor viewed objectives as a Theory Y concept!) A critical incident study by White and Locke (1980) found that goal setting and its equivalents (e.g., deadlines, a heavy work load) were associated with high productivity (and the negatives of goal setting with low productivity) more frequently than any other factor. In the Locke et al (in press) analysis referred to above, goal setting was the second most effective motivational technique. The mean improvement in performance in studies which assigned workers specific challenging goals was 16%.

If we combine the effects of Taylor's two main motivators, money and goals, or the task and the bonus as he called them, we get an expected or potential performance improvement of 46%. The figure is very close to the figure of a 40% mean performance improvement obtained in studies of individual task and bonus systems (Locke, et al, in press).
 A survey of 453 companies^{Fein,} (1973) found that task and bonus systems combined yielded productivity increases even greater than 40%.

Compare these results with what Locke et al (in press) found with respect to the two remaining techniques. The median performance improvement for the job enrichment studies was between 9% and 17%. The former figure is probably more accurate since the latter includes some possibly contaminated (poorly controlled) studies. When the results were broken down separately by quality and quantity, the performance improvement turned out to be almost exclusively with respect to quality (see also Lawler, 1969/1970). Furthermore, the quality improvements may have been due entirely to the effects of feedback, which, in most job enrichment studies, is one of the main things provided (or provided in more detail or more frequently than before) to employees. As noted earlier, feedback affects performance only in conjunction with goal setting. Thus it may be that the effects of job enrichment on performance will ultimately reduce to an as yet unacknowledged goal setting effect (for supportive evidence, see Umstot, Bell & Mitchell, 1976).

The results for the studies of participation in decision-making are even bleaker. The median performance improvement for all available controlled field studies in the Locke et al (in press) analysis was 0.5%--in other words, essentially zero.

Consider then the sum total of these results: the two motivators used by Taylor yield more than a 40% performance improvement. Job enrichment yields a small improvement which may be reducible to a goal setting effect. (It will be recalled that Behavior Mod in organizations also typically involves goal setting; Locke, 1977) And participation, as a motivator, yields nothing. Therefore it could be argued,

that with respect to motivation techniques, not a single method of substance has been added to those used by Taylor.

Of course, one cannot claim that Taylor had anything approaching a complete theory of human nature or a complete understanding of work motivation. Taylor himself acknowledged this (1911/1967, p. 119). But one must be impressed by how effective his techniques were and by how little has been added, at least by way of effective techniques, since his time.

2. Taylor failed to grasp the importance of social factors. The Hawthorne studies (Roethlisberger & Dickson, 1939/1956) were supposed to represent a great enlightenment: they allegedly "discovered" the influence of human relations or social factors on worker motivation. We have already noted that many of the conclusions the Hawthorne researchers drew from their own data were probably wrong (Franke and Kaul, 1978). But beyond this, much of what they said was not even original. Much has been made of the studies in the Bank Wiring Observation Room which found that workers developed informal norms which led to restriction of output. It has been claimed that this discovery refuted Taylor's alleged assumption that workers respond to incentives as isolated individuals. Actually Taylor made no such assumption. In fact, he had identified exactly the same phenomenon as the Hawthorne researchers several decades earlier. He called it "systematic soldiering" (see also the comments by Boddewyn, 1961). Not only did Taylor recognize restriction of output but one of the chief goals of Scientific Management was to eliminate it! He viewed soldiering as wasteful and as contrary to the interests of both management and the worker.

The main difference between Taylor and Mayo (director of the Hawthorne studies) was that Taylor viewed soldiering as a problem caused by poor management and which could and should be eliminated by Scientific Management, while Mayo saw it as a reflection of an ineradicable human need. While one can acknowledge that friendship is a need, there is little evidence to support the view that workers' major friendships are made in the workplace or the notion that friendships in the workplace must result in restriction of output.

Nor was Taylor unaware of the effect of social comparisons on worker morale. Discussing the need for the worker to perceive incentive systems as fair, relative to what other workers were getting, he said, "sentiment plays an important part in all our lives; and sentiment is particularly strong in the workman when he believes a direct injustice is being done him " (quoted in Copley, 1923, Vol. II, p. 133).

Taylor was also aware of "social factors" at a deeper level. Scientific Management itself involved a "social" revolution in that it advocated replacing management-labor conflict with cooperation. His ultimate goal was to improve the welfare of society by increasing wages and production and lowering costs to the consumer.

3. Taylor was authoritarian. Authoritarianism means the belief in obedience to authority simply because it is authority--obedience for the sake of obedience. Such a doctrine was clearly in total contradiction to everything Taylor stood for. First and foremost he stood for obedience to facts--to reason, to proof, to experimental findings. It was not the rule of authority that he advocated but the

rule of knowledge. To quote Taylor biographer F. B. Copley, "there is only one master, one boss; namely, knowledge. This, at all events, was the state of things Taylor strove to bring about in industry. He there spent his strength trying to enthrone knowledge as king" (1923, Vol. I, p. 291).

Taylor did not advocate participation among his uneducated, manual workers simply because they did not have the requisite knowledge to do their jobs in the "one best way." He would summarily overrule workers if he believed that he was right; for example, he shortened the working hours of the ball bearing inspectors even when they indicated that they did not want any such reduction (despite the promise of no loss in pay), because the evidence indicated that their work day was too long (Taylor, 1911/1967, pp. 88ff). The positive results vindicated his judgement. Similarly, most workers, when they first heard about the task and bonus system, wanted no part of it. But when Taylor showed them how it would actually benefit them (sometimes, to be sure, accompanied by pressures,) most embraced it enthusiastically and performed far better as a result. Nor was Taylor adverse to suggestions from workers (see also Gilbreth, 1914/1973, pp.68-69). He wrote , "Every encouragement . . . should be given to him to suggest improvements, both in methods and in implements. And whenever a workman proposes an improvement, it should be the policy of the management to make a careful analysis of the new method, and if necessary conduct a series of experiments to determine accurately the relative merits of the new suggestion and of the old standard" (Taylor, 1911/1967, p. 128).

Fisher quotes Copley on this issue as follows, "If you could prove that yours was the best way, then he would adopt your way and feel very much obliged to you. Frequently he took humble doses of his own imperious medicine," (Fisher, 1925/1976, p. 172).

I believe that the worst influence of the human relations movement (and I am not against everything it stands for) has been to put far too much emphasis on the primacy of the workers' feelings and too little on knowledge and facts. There is an implication that if the workers do not like what you are doing, by that fact alone, regardless of the reasons or the evidence, you are a poor manager and are doing something wrong (see Locke, & Schwieger, 1979, pp. 325ff, for a more detailed discussion of this issue).

A comment made by noted humanist, Abraham Maslow, late in his life, provides an excellent antidote to this trend: "More stress needs to be placed on the leader's ability to perceive the truth, to be correct, to be tough and stubborn and decisive in terms of the facts." Instead of stressing, "democracy, human relations and good feeling. There ought to be a bowing to the authority of the facts" (Maslow, 1970, p. 36).

4. Taylor over-emphasized specialization of labor. There is a little doubt that Taylor emphasized maximum specialization, not only for workers but for foremen (e.g., functional foremanship) and managers was well. His argument was the traditional one, that specialization decreased learning time and increased competence and skill. To evaluate this criticism, we must ask: How much emphasis is over-emphasis?

Advocates of job enrichment have argued that extreme specialization leads to boredom and low morale and lack of work motivation due to underutilized mental capacity. On this issue, it should be noted that Taylor always argued for a matching of men to jobs in accordance with their capacities. People who do jobs which require very little mental capacity should be people who have very little mental capacity (Taylor, 1903/1947, p. 28). Those with more capacity should have more complex tasks to perform (e.g., by being promoted when they master the simple tasks; see Gilbreth, 1914/1973; p. 54; and Taylor, 1912/1970a, p. 101) In this respect Taylor might very well approve of individualized job enrichment, although, as noted earlier, its effects on performance may be limited. (I do not agree, however, with Drucker's 1976, claim that Taylor anticipated Herzberg's theory.)

The separation of planning from doing again was for the purpose of matching men to the job for which they were best suited and of maximizing each worker's skill. Where planning is done expertly, it is likely that such a division of labor will result in higher productivity despite possible costs in terms of morale.

There is a potential benefit of job enrichment (e.g., multicrafting and modular working arrangements), however, which Taylor probably did not foresee. There are fewer and fewer jobs in existence today which stay unchanged for long periods of time. If such jobs exist, they are eventually automated. People are more versatile than machines precisely because of their greater flexibility and adaptability. In times of rapid technological change, such as the present,

spending months training a worker for one narrow specialty would not be very cost-efficient. It is more practical to have each worker master several different jobs and to work each day or hour where they are most needed.

With respect to supervision, Taylor's concept of functional foremanship clearly has not been accepted and probably is not very practical. (It has been suggested by Drucker, 1976, that functional foremanship could be considered the progenitor of matrix management, although I believe this may be giving Taylor too much credit.) Similarly, it now seems clear that a product rather than a functional organization is often the most efficient organizational design.

5. Taylor's system treated men as machines. This criticism is related to the previous one; it usually refers to the fact that Scientific Management required complete uniformity for a given job with respect to the tools and motions used by the workmen. The reason for this was that each task was to be done in the "one best way," based on all the knowledge available, in order to achieve maximum efficiency. As noted earlier, Taylor was not against the workers making suggestions for improvements, providing they first mastered the best known methods. Taylor's well-chosen example of this principle was that of training a surgeon, "he is quickly given the very best knowledge of his predecessors [then] . . . he is able to use his own originality and ingenuity to make real additions to the world's knowledge, instead of reinventing things which are old" (1911/1967, p. 126). The alternative to "treating men as machines" in the above sense was the pre-scientific method of management which allowed men

to choose tools and methods based on personal opinions and feelings rather than on knowledge.

It is often forgotten that standardization included the re-design of machines and equipment in order to enable men to become more skilled at the tasks they performed. Taylor applied this principle as much to himself as to others. His unique modifications of the tennis racket and the golf putter for his own use are cases in point³. As noted earlier, he did not force people to fit existing equipment. He, and the Gilbreths, (re-)designed equipment to fit people.

It might be more accurate to say that Taylor, rather than treating men as machines, helped to develop the science of integrating men with machines.

6. Taylor's system exploited the workers. During Taylor's lifetime, socialist Upton Sinclair and others claimed that Taylor's system was exploitative because, while under Scientific Management the worker improved his productivity by around 100%, his pay was only increased 30% to 70%. In fairness, they argued, the pay increase should match the productivity increase.

Taylor easily refuted this argument (cited in Fisher, 1925/1976, p. 183; see also Copley, 1923, Vol. I, p. 317 , footnote 1). He pointed out, for example, that the increase in productivity was not caused only by the worker but also by management; it was management who discovered the better techniques and designed the new tools, at some cost to themselves. Thus they deserved some of the benefits as well (Taylor, 1911/1967), p. 137).

Sinclair's failure to grasp this issue may have been the result of being blinded by Marx's labor theory of value which asserts that value rests only in effort. It ignores the fact that to be valuable, the effort expended by a worker must be an intelligent effort, i.e., effort based on knowledge. In business all relevant knowledge does not come from the workers. It is the job of managers to insure that the effort being expended by workers is intelligent, i.e., will sell in the market place.

Ironically, Lenin, the self-proclaimed enemy of so-called "capitalist exploitation", himself strongly advocated the application of Scientific Management to Russian industry in order to help build socialism. However, socialist inefficiency, hostility to "capitalist ideas" and resistance to change prevented the application of virtually all Scientific Management techniques in Russia except for the Gantt chart (see Wren, 1980).

7. Taylor was anti-union. This is true only in one sense: Taylor foresaw no need for unions once Scientific Management was properly established, especially since he saw the interests of management and labor as fundamentally the same (e.g., see Copley, 1925/1976). It is worth noting in this respect that companies which are known for treating their employees well, such as IBM, do not have unions. The belief that unions were unnecessary under the proper type of management did not indicate lack of concern for employee welfare. The leaders of the Scientific Management movement, including Taylor, showed great concern with the effects of company policies on employee well-being (e.g., see Sheldon, 1924/1976, pp. 44ff). For example,

observe their constant preoccupation with eliminating or reducing fatigue. Taylor was generally more critical of management than of labor, although he did become quite irritated when labor unions launched a concerted attack on his ideas (Copley, 1925/1976). This benevolence however, did not always characterize the followers of Taylor who often tried to short-cut the introduction of his methods and engaged in rate-cutting and other deceptive practices.

8. Taylor was dishonest. The strongest condemnations of Taylor, specifically of Taylor's character, have come in two recent articles (Wrege and Perroni, 1974; Wrege and Stotka, 1978). The first asserts that Taylor lied about the conduct of the famous pig-iron handling experiments at Bethlehem steel, and the second claims that Taylor plagiarized most of his Principles of Scientific Management from a colleague, Morris L. Cooke.

Let us consider the pig-iron experiments first. It seems clear from Wrege and Perroni (1974) that, in relation to these experiments, Taylor did stress different things in the three reports of it that appeared in his writings. However, these descriptions were not contradictory to one another; they differed only in terms of emphasis and in the amount of detail presented. This in itself does not constitute dishonesty, unless it can be shown that there was an intent to mislead the reader.

Taylor was apparently in error as to certain details, (e.g., the amount of tonnage of iron involved) but these could have involved errors of memory rather than deliberate deception. Nor do these details change the thread of his arguments.

Wrege and Perroni also claim that Schmidt (actual name: Henry-Knolle) was not selected scientifically for the job of pig-iron handling as claimed, but was simply the only worker who stuck with the task from the beginning to the end of the introductory period. This claim would appear to be true unless James Gillespie and Hartley Wollé, who conducted most of the research, omitted pertinent information in their report. However, if one accepts the idea (noted earlier) that by a "first class" workman Taylor meant one who was not just capable but also highly motivated, then the choice of Schmidt was not inconsistent with Taylor's philosophy.

In addition, Wrege and Perroni could find no evidence that local papers had opposed Taylor's experiments as he had claimed. However, it is possible that Taylor was referring to some other paper or papers. Wrege and Perroni do not indicate if the papers they looked at were the only ones published in the Bethlehem area or surroundings areas at that time.

Wrege and Perroni argue further that Taylor never acknowledged that his "laws of heavy laboring" were based on the work of "two extraordinary workers" (1974, p. 21). However, in Principles of Scientific Management, Taylor (1911/1967, p. 60, footnote 1) clearly states". . . . a first class laborer, suited to such work as handling pig iron, could be under load only 42 per cent of the day and must be free from load 58 per cent of the day" (italics mine). In short these laws were specifically for extraordinary workers.

Wrege and Perroni claim that Taylor lied about giving the workers rest pauses, because all of the rest periods referred to involved only the return walk after loading the pig-iron rather than an actual seated or motionless rest period. However, if one reads Taylor's Principles. . . carefully, one notes that he specifically described his laws of heavy laboring in terms of how much of the time the worker can be "under load" (Taylor, 1911/1967, pp. 60-61, footnote 1). This implies that the return walk was the part not under load. Furthermore near the end of footnote 1 (p. 61), Taylor states, "Practically the men were made to take a rest, generally by sitting down, after loading ten to twenty pigs. This rest was in addition to the time which it took them to walk back from the car to the pile" (italics mine). No evidence in Wrege and Perroni's (1974) article contradicts this assertion; nor do they even mention it.

As to the Wrege and Stotka (1978) claim that Taylor plagiarized most of his Principles. . . from a manuscript written by a colleague, Morris Cooke, several facts should be noted. First, Cooke's manuscript was based on a talk written and presented by Taylor himself. Apparently Cooke added to it but the source of the additional material is not actually known (it could have been from other talks by or discussions with Taylor). Cooke himself gave Taylor credit for this allegedly plagiarized material (Wrege and Stotka, 1978, pp. 746-747). Fry argues that, "It is ludicrous to accuse Taylor of plagiarizing Cooke if in fact Cooke's material was based on Taylor's own talks" (1976, p. 128). Second, Taylor published Principles. . . with Cooke's full knowledge and apparent consent. Third, Taylor offered

Cooke all the royalties lest his book reduce the sales of a similar book Cooke planned to author himself. All of this is hardly consistent with Wrege and Stotka's implication that Taylor was a dishonest exploiter. Actually we do not know the reasons why Cooke agreed to let Taylor be sole author of the manuscript. Perhaps Cooke thought it would get better acceptance, or that Taylor deserved sole authorship because all the ideas were his or because he was the leader and founder of the movement. At most Taylor can be accused of lack of graciousness due to his failure to acknowledge Cooke's editorial work.

It is also puzzling why, if Cooke actually wrote most of Principles . . . , Wrege, Perroni and Stotka did not accuse Cooke as well as Taylor of dishonesty in reporting the pig-iron experiments. This, of course, would make Scientific Management begin to look like a giant conspiracy--an accusation for which there is no evidence.

Wrege and Perroni (1974) also accuse Taylor of not giving due credit to Gillespie and Wolle for their work on the Bethlehem studies. While Taylor did not acknowledge in print every assistant who ever worked with him, he did acknowledge his indebtedness to many colleagues in Principles. . . including, Barth, Gilbreth, Gantt and Thompson. He also used the term "we" when describing the Bethlehem experiments. Thus he was clearly not in the habit of taking all credit for himself as Wrege and Stotka (1978) charge. Again, however, a footnote acknowledging the work of Gillespie and Wolle would have been appropriate.

In my opinion, the evidence that Taylor was dishonest is not only far from conclusive, it is virtually non-existent. On the grounds of practicality alone, it seems very doubtful that Taylor, who worked and performed experiments with so many different people, would deliberately attempt to distort what was done or who did it and thus leave himself open to exposure by any one of them.

Conclusion

Let us now sum up. With respect to the issues of a scientific approach to management and the techniques of time and motion study, standardization, goal setting plus work measurement and feedback, money as a motivator, management's responsibility for training, scientific selection, the shortened work week and rest pauses, Taylor's views were not only essentially correct but have been well accepted by management. With respect to the issues of management labor relations and individualized work, he was probably only partially correct and has been only partially accepted. These issues are summarized in Table 1.

Insert Table 1 Here

With respect to criticisms, the accusations regarding: Taylor's inadequate model of worker motivation, his ignorance of social factors, his authoritarianism, his treatment of men as machines, his exploitation of workers, his anti-unionism and his personal dishonesty are predominantly or wholly false. Several of them verge on the preposterous. The accusation of over-specialization seems partly but not totally justified (see Table 2 for a summary of these points).

Insert Table 2 Here

Considering that it has been over 65 years since Taylor's death and the knowledge explosion that has taken place during these years, I consider his track record to be remarkable. The point is not, as is often claimed, that he was "right in the context of his time," but is now outdated, but that most of his insights are still valid today. I agree with those who consider Taylor a genius (e.g., Johnson, 1980). His achievements are all the more admirable because, while Taylor was highly intelligent, his discoveries were not made through sudden, brilliant insights but through sheer hard work. His metal-cutting experiments, for example, spanned a period of 26 years (Taylor, 1912/1970a, p. 95)!

Drucker (1976) claims that Taylor had as much impact on the modern world as Karl Marx and Sigmund Freud. This may be true in that Taylor's influence was certainly world-wide and has endured long after his death (Wren, 1979). (Of the three, however, I consider Taylor's ideas by far the most objectively valid.) But the historical figure Taylor most reminds me of is Thomas Edison (e.g., see Runes, 1948)--in his systematic style of research, in his dogged persistence, in his emphasis on the useful, in his thirst for knowledge, and in his dedication to truth.

Will the real Frederick W. Taylor please stand up and take a bow.

Footnotes

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²This information was supplied by Dr. J. Myron Johnson based on documents in the Taylor Collection at the Stevens Institute of Technology.

³Both items are on display at the Stevens Institute of Technology.

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TABLE 1

Status of Taylor's Ideas and Techniques in Contemporary Management

<u>Philosophy</u>	<u>Valid?</u>	<u>Now Accepted?</u>	<u>Manifested in (outgrowths):</u>
Scientific decision-making	Yes	Yes	Management science: operations research; cost accounting; marketing; purchasing; inventory control; planning (PERT charts); human engineering, etc.
Management-labor cooperation	Yes	Partly	Greater management-labor cooperation
<u>Techniques</u>			
Time & motion study	Yes	Yes	Widespread use; standard times
Standardization	Yes	Yes	Standardized procedures in all spheres; human engineering.
Task	Yes	Yes	Goal setting; MBO; feedback; performance measurement
Bonus	Yes	Increasingly	Proliferation of reward systems; Scanlon Plan; Improshare; need to consider money in job enrichment/OD studies
Individualized work	Partly	Partly	Recognition of dangers of groups: groupthink, social loafing; contextual theories of group decision-making
Management training	Yes	Yes	Management responsibility for employee training
Scientific selection	Yes	Yes	Development of fields of industrial psychology and personnel management
Shorter hours; rest pauses	Yes	Yes	40 hour (or less) work week: common use of rest pauses

TABLE 2
Validity of Criticisms of Taylor's Ideas

<u>Criticisms</u>	<u>Valid?</u>	<u>Relevant facts</u>
Inadequate theory of work motivation	No	Money and goals are the most effective motivators
Ignored social factors	No	SM designed specifically to facilitate cooperation and to eliminate negative effects of social factors; awareness of sentiments
Authoritarianism	No	Stressed rule of knowledge (the essence of SM)
Over-specialization	Only partly	Specialization maximized expertise; match men to job requirements (but ignored possible benefits of multi-crafting)
Treated men as machines	No	Methods based on knowledge, not feelings
Exploitation of workers	No	Management deserves some of benefits of increased efficiency, based on its contribution
Anti-unionism	No	Unions not needed under good management
Dishonesty	No	Accusations based on incomplete or false information